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ABSTRACT

A study examined adoption of computer communication technology by communication faculty in a sample of schools of communication in which online database services and electronic mail were made available to individual faculty members without cost or access barriers. A mail survey sent to 178 faculty at 10 institutions was returned by 115 faculty, for a return rate of 64.6%. Results indicated that: (1) only a little more than half of the respondents reported using the computer services (Mead Data Central's Lexis/Nexis full-text database service) or electronic mail; (2) neither gender nor age nor availability of a computer at the workplace were related to computer use; and (3) almost all of the professors said they used a personal computer for some purpose, mostly word processing. Results also indicated that a scale based on S. Ram's Model of Innovation Resistance predicted usage of Lexis/Nexis. (Contains 39 notes and four tables of data.) (RS)

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RESISTANCE TO THE ADOPTION OF COMPUTER COMMUNICATION TECHNOLOGY BY COMMUNICATION FACULTY

by

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Paper presented to the Communication Technology and Policy Division, AEJMC, 1994 meeting, Atlanta.

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RESISTANCE TO THE ADOPTION OF COMPUTER COMMUNICATION TECHNOLOGY BY COMMUNICATION FACULTY

The National Information Infrastructure (NII) or "information superhighway" has been referred to in White House press releases as something that will "help unleash an information revolution that will change forever the way people live, work, and interact with each other."[1] A great deal of debate has focused on who will provide these information resources that will reach the nation's schools, offices and factories and what content they will carry. However, little has been said about whether these new information resources will actually be used once they get there.

This study looks at adoption of computer communication technology by faculty in a sample of schools of communication in which online database services and electronic mail were made available to individual faculty members without cost or access barriers. This resulted in a quasi-experimental situation in which a high rate of adoption was expected under such ideal conditions.

Once these new communication technologies were made readily available to faculty, a high rate of adoption was expected for several reasons. Communication professors have easily realizable rewards for using them, including the benefits of more efficient lesson preparation and improved research. They are motivated by a variety of pressures to keep current with developments in the field. Financial barriers to adoption are low since most professors can get the necessary equipment, such as computers and modems, at no cost to themselves. Finally, these individuals are in an environment that

is oriented toward the acquisition of new skills and includes knowledgeable people that could be consulted for training.

Computer Communication and Mass Communication: Practitioners and Educators

With the increasing computerization of information resources, the need to know about new information technology has become crucial to professional communicators. Miller considers computer databases the principal innovation that has revolutionized access to information, which he calls the "retrieval revolution."[2] The use of online database technology has grown explosively since its inception only some 30 years ago.[3] Currently, the full texts of over 100 United States newspapers and nearly 1,000 trade publications and magazines are available electronically from commercial database vendors such as Mead Data Central's Lexis/Nexis system, Knight-Ridder's VU/Text, Dow-Jones News Retrieval Service, and others.[4]

The ability to send and receive information using electronic mail is also becoming more important. Email messages can be sent to almost any location in the world at virtually no cost to the user through Internet, a network of computers that spans the globe.[5] Along with email, Internet allows access to a wide range of information resources, including government databases, library catalogs and discussion groups made up of individuals with common interests.[6]

Several of these discussion groups specialize in areas of interest to mass communication faculty and practitioners. These include Renssalaer Polytechnic Institute's Comserve lists, the Computer-Assisted Research and Reporting List (CARR-L), and Journalism Educators Network. Members of these electronic mailing lists discuss

topics related to teaching and research and frequently exchange articles, syllabi, and advice on research problems.[7]

Despite the growing importance of electronic information resources in the newsroom and throughout a wide array of other institutions, instruction in computer communication technology in schools of journalism has been limited. Johnson states that journalism educators have failed to realize the magnitude of change that has accompanied the spread of new technologies.

> . . . a large majority of journalism students - indeed, the great mass of all students in most universities - are not being adequately prepared to cope with the information-retrieval and analysis environment that is used daily by government and business, and a steadily increasing number of print and broadcast companies. Our students, therefore, are being defrauded, bilked out of the skills vital to their intellectual and professional due.[8]

A 1991 survey of 258 journalism schools conducted by DeFleur and Davenport revealed that only one-third offered or planned to offer courses featuring online database usage and other computer communication skills.[9] In contrast, a 1990 study revealed that almost 90 percent of the 105 newspapers with a daily circulation of over 100,000 were found to subscribe to commercial online databases.[10] Defleur and Davenport's findings suggest that journalism schools are suffering from an innovation lag.[11] They state that journalism schools are lagging behind the industry in the adoption of crucial new technologies. Their study, however, looked at adoption by schools as a whole rather than investigating adoption behavior by individuals within those institutions.

Research on the Adoption and Diffusion of New Technologies

Rogers' diffusion of innovation model is regarded as the most widely known description of the diffusion process. This model categorizes potential adopters of an

innovation by innovativeness, the degree to which an individual or group adopts a new idea earlier than other members of a social system. Innovativeness is normally distributed among adopters, who are labeled innovators, early adopters, early majority, late majority, and finally laggards.[12] This typology, however, fails to address those who do not adopt.

Diffusion research has been criticized because of its pro-innovation bias. Pro-innovation bias is the belief that all innovations are beneficial for all potential adopters and that the objective of such research should be to increase the rate and extent of innovation diffusion.[13] This viewpoint regards any resistance to innovation as a merely irrational reaction or simply something to be ignored as unimportant.

Although a considerable number of innovations have failed despite great expectations, unsuccessful innovations have largely been neglected. Examples of rejected communication technologies abound, including educational television in the 1960s,[14] information services such as Knight-Ridder's attempted mass-market videotext project, Viewtron,[15] interactive cable television,[16] electronic banking,[17] picturephones, and quadraphonic stereo.[18] However, studies that have sought an explanation for factors that led to the failure of innovations such as these have been limited. The factors behind rejection remain to be fully explored.

The majority of innovation studies published are investigations of innovations that have successfully diffused.[19] The phenomenon of resistance to innovation has been the subject of few studies and is not well understood. The reluctance of researchers to study resistance to innovation has led to its being called the "less developed concept" in

diffusion research.[20] The study of resistance considers qualitative factors of adoption present in the innovative-decision process rather than solely charting the rate of adoption over time, as is the case with the majority of diffusion studies.

Some researchers believe that resistance to innovation may be a form of normal resistance to change in general. Such resistance may function as a necessary stabilizing force in society. Klein sees those who resist change as necessary "defenders" of the social system who are trying to

> ward off threat, maintain integrity of the system and protect against the unwarranted intrusions of others' demands against . . . ill-considered and overly precipitous innovations.[21]

Stern, possibly the earliest student of resistance to technological innovation, stated that

> Predictions based upon the assumption that if valuable or profitable technological inventions are but conceived, they will be incorporated into industrial life, ignore the evidence of past experience.[22]

Stern has written a detailed history of innovations that have had to overcome great initial resistance, including railroads, the automobile, the telegraph, the telephone, the typewriter, and even the bathtub.

According to Stern, such resistance is tied to a need for stability because of the difficulty of expending one's energies continuously on making decisions. Innovation, however, has a tendency to disrupt this behavioral inertia.

> An innovation, especially one which affect's one's economic status as in the case of technologies, rudely shatters whatever equilibrium a person has attained. It demands not only motor reconditioning but reorganization of personality to meet the needs of the new situation. It is little wonder that an innovation . . . provokes feelings of impropriety, and repelling defense attitudes of ridicule and disparagement, or is deliberately ignored.[23]

Ram's Model of Resistance to Innovation

Ram has devised a model that enumerates the factors behind resistance to innovation. These factors are categorized into three areas: (1) innovation characteristics, (2) consumer characteristics, and (3) characteristics of propagation mechanisms.[24] Each of these three areas is made up of several corresponding sub-areas and components.

Rogers established five general innovations characteristics: relative advantage, compatibility, complexity, trialability, and observability.[25] Ram has added six innovation characteristics to the five proposed by Rogers. These include perceived risk, divisibility, reversibility, realization, amenability to modification, and effect on adoption of other innovations.

Ram has specified nine factors of consumer characteristics. These are further divided into two categories, psychological variables that include perception, motivation, personality, attitudes, beliefs, previous innovative experience and demographic variables such as education, income and age.[26]

Ram classifies characteristics of propagation mechanisms such as change agents and opinion leaders based on two dimensions: (1) extent of marketer control, which may range from high to low, and (2) type of contact with the consumer, which varies from personal to impersonal.[27] The role of these factors varies with the innovation's life cycle. Marketer-controlled sources have been found to be greater at the early stages and personal contacts more important in later stages.[28]

Ram suggests that resistance may be found in varying levels throughout each of Rogers' five stages of the adoption process.[29] While obviously a major factor in the rejection of innovations, resistance may be present even after an innovation is adopted. Ram also believes that resistance to innovation can be tied to broader resistance to change theories such as those proposed by Heider and Newcomb.[30]

Method

The research focused on faculty at schools that have an educational subscription to Mead Data Central's Lexis/Nexis full-text database service. Lexis/Nexis is an important information resource widely used in the communications industry. An important feature of the educational subscription is its discounted flat-rate, which makes the service accessible to individual faculty at no charge to themselves.[31] This allowed control for cost and access factors affecting individuals' use of the Lexis/Nexis system. Electronic mail is similarly available without charge to faculty. In other words, neither cost nor access were a problem for those studied, resulting in a quasi-experimental situation in which the remaining factors were expected to be more readily discernable.

A mail survey of faculty at ten institutions was conducted. A total of 178 professors made up the sampling frame.[32] The mail questionnaire consisted of questions designed to elicit information in three primary areas: (1) use of computers and computer communication technologies, (2) personal information, and (3) resistance to computer communications. Ram's model was used as an organizing framework in the development of a scale designed to measure the level of resistance to technological innovations.[33] The survey instrument was pretested using a small convenience sample

of university faculty. The form was subsequently modified to clarify ambiguous or poorly worded questions and make response easier.

All possible measures were taken to maximize the response rate. Cover letters for each school were devised which clearly identified the educational institution sponsoring the research, described the nature of the project and stressed the importance of returning a completed form. A stamped, addressed envelope was included for the convenience of the respondents. The questionnaire, cover letter and envelope were placed in a high-quality envelope to make a complete questionnaire packet, which was placed in the mailbox of each full-time faculty member by a contact person at each school. This method guaranteed that each faculty member at the selected institutions would receive a packet and also served to reduce postage costs.

Findings

Out of 178 forms that were successfully distributed, a total of 115 were returned, yielding an overall return rate of 64.6 percent.[34] The representativeness of the survey is supported by examining the gender of the respondents. Of the 115 respondents, 83 (72.2 percent) were male and 32 (27.8 percent) were female. This ratio is similar to that of the population surveyed.[35] A chi square analysis of the response to the survey reveals that there is statistical support for the absence of a gender bias (X^2 = .578, df = 1, p = .473).

Computer Communication Usage. As Table 1 shows, only a little more than half of the respondents reported using Lexis/Nexis. These individuals were classified into four groups according to the frequency of their usage. Heavy users, categorized as those

who reported using the service several times per day or about once per day, made up about 10 percent of the sample. Almost a third (29.6 percent) said they used it several times per week or about once per week. These were classified as medium users. Light users, those who reported using the service about once per month, were only 12.2 percent of those surveyed. Almost half, 47.8 percent, indicated using it less than once per month or never, and were labeled non-users.

Table 1

FREQUENCY OF ONLINE DATABASE USAGE

	N	Percent of sample	Percent of users
Heavy	12	10.4	20.0
Medium	34	29.6	56.7
Light	14	12.2	20.3
Non-users	55	47.8	0.0
Totals	115	100.0	100.0

A similar pattern emerged for email usage. As Table 2 reveals, only 62 of the 115 professors, or 53.9 percent, said they use email. Two usage levels were devised for the amount of reported email use. Respondents who sent or received more than twenty messages in an average week were categorized as heavy users. Light users were identified as those who said they used email, but sent or received twenty messages or less per week.

Table 2

VOLUME OF ELECTRONIC MAIL

SENT AND RECEIVED PER WEEK

Level of usage	Sent		Received	
	N	Percent	N	Percent
Heavy	13	11.3	24	20.9
Light	49	42.6	38	33.0
None	53	46.1	53	46.1
Totals	115	100.0	115	100.0

Personal Information. The survey also asked respondents to reveal information about their personal characteristics and access to and use of computers. Cross-tabulations of frequencies were devised and chi square analyses were performed to determine the statistical significance of any possible association between the use of the technologies under study and the selected variables. In all cases, the null hypothesis used in each analysis was that there was no association between usage and the particular variable in question. Table 3 summarizes the results of these tests.

Table 3

CHI SQUARE TESTS OF ASSOCATION BETWEEN

PERSONAL INFORMATION AND COMPUTER COMMUNICATION USAGE

		Lexis/Nexis		Email	
Variable	df	X^2-value	p-value	X^2-value	p-value
Gender	1	1.261	.261	1.843	.175
Age	3	1.149	.765	3.742	.291
Academic rank	3	5.489	.139	3.617	.306
Ed. level (Ph.D.)	1	.550	.458	8.819	.003
Teaching time	1	4.328	.037	.063	.801
Research time	1	4.104	.043	.321	.571
Work comp. avail.	1	.259	.611	.367	.545
Home comp. avail.	1	3.965	.046	7.481	.006
School modem	1	34.400	>.001	4.283	.039
Home modem	1	9.815	.002	14.406	.001
Computer usage	1	6.978	.008	5.509	.019
Lexis/Nexis usage	1	-	-	6.206	.013

As Table 3 shows, no significant association was found between Lexis/Nexis or email use and gender. Similarly, age was not related to whether a professor was or was not a user of the technologies. The relatively high average age of 45.2 years suggests that one can "teach an old dog new tricks." Academic rank was not associated with usage. Education level, however, was related to usage of email. Those having a Ph.D

were more likely to use email than those without, a finding which did not hold for Lexis/Nexis use.

The professors were asked about the amount of time they spent teaching. The responses yielded an average time of 48.1 percent. Those who said they spent more than the average time teaching were less likely to use Lexis/Nexis. Similarly, those who reported their time devoted to research as more than the average of 24.9 percent were more likely to be Lexis/Nexis users. No such relationship was found for email use and allocation of work time.

Almost all (93.9 percent) of the respondents said they had access to a personal computer at their workplace. No association was found between workplace computer access and usage of either Lexis/Nexis or email. A similarly high number of respondents (89.6 percent) reported having a home computer. A computer in the home, however, was found to be related to usage of both Lexis/Nexis and email. The low number of those that said they did not have a computer available either at school or at home renders the chi square results suspect.[36] However, it can be tentatively concluded that since personal computers are so widely distributed, any consideration of their availability as a factor in computer communication usage may be meaningless.

A little over half (55.6 percent) said they had a modem or other connection for their computer at school. A larger number (68.7 percent) claimed to have a modem for their home computer. Having a modem in either one's school or home computer was related to using the technologies.

Almost all of the professors (96.5 percent) said they used a personal computer for some purpose, mostly word processing. The amount the respondents used their personal computer for various tasks was a factor related to usage. Heavy users, those who said they used their computer an average of three hours or more a day, were more likely to use both Lexis/Nexis and email than light users, those that said they used a computer less than three hours a day. Finally, users of Lexis/Nexis were more likely to be users of email than those who were users of only one of the two technologies. About a quarter of the respondents (27.8 percent) said they used neither.

Resistance to Innovation. Respondents were asked to indicate their beliefs about online database technologies such as Lexis/Nexis on a Likert-type scale designed to measure resistance to innovation. This scale was based on Ram's 19 resistance factors. Four additional items were added following a pretest of the scale, resulting in a scale that included a total of 23 items designed to gauge resistance to computer communication technology.[37]

Fifteen items concerned beliefs about innovation characteristics. Eight items referred to the respondents' beliefs about themselves with regard to computer communication technology. The professors surveyed were given the choice of replying "strongly agree," "agree," "don't know," "disagree" or "strongly disagree" to each statement.

The results were coded so that higher total scores could be interpreted as indicating a lower level of resistance to innovation. The scale was subjected to an item analysis using the "known groups technique" as described by Likert.[38] Statistical evidence was found for the validity of all 23 of the belief scale items. The *t* statistics for

Table 4

RESISTANCE SCALE ITEM ANALYSIS

Item	*t*
1A. Relative advantage. "is more convenient."	12.115
2A. Relative advantage. "can save time."	11.868
3A. Relative advantage. "improves productivity."	11.979
4A. Compatibility. "compatible with the way I like to work."	10.151
5A. Pervasiveness. "would require me to change work habits."	9.101
6A. Psychological risk. "entails little or no risk to me."	5.904
7A. Social risk. "can be embarrassing."	4.496
8A. Complexity. "is just too complex for me."	7.064
9A. Effect on other innovation adoption. "makes me optimistic."	10.966
10A. Trialability. "can be easily tried out."	5.266
11A. Divisibility. "can be practiced at a comfortable pace."	10.389
12A. Reversibility. "can be discontinued easily."	6.665
13A. Realization. "shows its benefits right away."	14.378
14A. Communicability. "can easily be communicated."	11.887
15A. Amenability to modification. "can be easily modified."	6.996
1B. Perceived need. "I need such services."	12.355
2B. Perceived need. "sufficient without it."	11.308
3B. Discontinuity. "more trouble than they are worth."	13.144
4B. Self-confidence. "I'm self-confident in my ability to use."	8.845
6B. Beliefs about innovation. "a positive development."	7.845
5B. Dogmatism. "I'm too set in my ways to use them."	15.181
7B. Attitude towards innovation. "They are a necessary evil."	6.282
8B. Previous innovation experience. "unwelcome innovation."	9.986

Items 1A-15A address beliefs about innovation characteristics.

Items 1B-8B concern respondents' beliefs about themselves.

28 degrees of freedom (shown in Table 4) resulted in probability levels of less than .0005, which meant that each scale item exhibited a significant level of validity.

A Spearman rank order correlation coefficient was calculated for respondents' total scores and their level of Lexis/Nexis usage. Higher belief scores and levels of general computer usage were found to correlate positively with an r of .34. Higher belief scores and levels of usage of Lexis/Nexis were found to correlate positively with an r of .49, which yields a coefficient of determination (r^2) of .24.

This high correlation coefficient can be interpreted as showing that the scale is a valid predictor of online database usage. Therefore, it can be interpreted that a higher level of resistance exhibited by an individual, as indicated by a low score, is likely to accompany a lower level of Lexis/Nexis usage.

Discussion and Conclusions

The respondents to this survey were professors at institutions that did not exhibit "innovation lag"--they all had access to Lexis/Nexis and email at no cost to themselves. However, despite the availability of these services, only about half the professors said they used them. This contrasts sharply with the near-universal adoption of computers for general purposes such as word processing.

This low rate of adoption by a group of individuals who ostensibly have compelling reasons to adopt new information technologies (made even more attractive by lack of cost and access barriers) raises important questions for purveyors of new communication technologies. Despite the ready availability of these valuable resources, almost half of the faculty failed to adopt these innovations that have obvious advantages for individuals whose livelihood depends on teaching and research involving access to information.

This has obvious ramifications for those seeking to pave new "information highways." The predictions made by those seeking to invest billions of investor and taxpayer dollars in these new technologies may be based on bluer skies than can realistically be expected. The professors in this study had a relatively low rate of adoption even under circumstances that were ideal for adoption. The average person will be more resistant to new information technologies, particularly since the ordinary person will probably have less clearly defined incentives to adopt. Furthermore, while costs were controlled for in this study, the average potential adopter will have to pay for the new services, which will further increase the level of resistance and lower the rate of adoption. The general result will most likely be that the adoption of these anticipated new technologies will occur at a slower rate than expected.

There are also important implications about the education of future communication professionals. If the average person is expected to see new technologies steadily make their way into more aspects of their daily lives, future practitioners will certainly be required to work in an increasingly computerized information workplace. Failure of their professors to adopt and understand these new technologies can only result in inadequate preparation for the new workplace environment. Many journalists may find themselves falling behind their counterparts in other sectors of society for whom these new technologies are becoming fundamental resources. The press' "watchdog" function may suffer if practitioners cannot adequately access information about government activities.

Within communication departments, widening divisions may arise between professors who have adopted the new technologies and their more resistant colleagues. Opposing groups may form which disparage each other either as "techno-nerds" or "global village idiots," depending on one's experience with new technology. These conflicts may become more heated as decisions about the allocation of resources become more difficult in an age of financial shortages.

The findings of this study also suggest that resistance is a concept valuable to the development of theory about the adoption process. A scale based on Ram's Model of Innovation Resistance was found to predict usage of Lexis/Nexis. Those who scored higher on the scale, and were therefore judged less resistant to the innovation, were more likely to use the service. Further study of the adoption process that incorporates the resistance perspective may prove to be useful in explaining and predicting why some innovations are adopted while others are forgotten.[39]

The present research was limited on several grounds. The design of the study, which took advantage of the quasi-experimental situation of schools that had a Lexis/Nexis educational discount, meant that the population studied was rather highly specialized. Further study of resistance to innovation needs to be done using subjects more representative of a broader population.

Further investigation is also needed to refine the theoretical perspective of innovation resistance. One potential study could be to isolate the factors of resistance to determine the relative importance of each component. Some factors may be more important than others under certain conditions, or certain combinations of factors may

yield different results. The resistance perspective should also be applied to a variety of innovations under different circumstances.

The study of adoption of innovation will continue to be an important area of future research. As more new communication technologies such as HDTV, interactive multimedia, and others become available, consideration of how resistance may affect the adoption of innovations will be of growing importance. The debate so far has been on how to get the horse to water without considering whether it will actually drink. This research has revealed that some horses might not be all that thirsty.

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29. S. Ram, "A Model of Innovation," 211.

30. Ibid., 209-210.

31. As of June 1, 1993, this discounted rate was $300 per month for the unlimited use of three passwords. In comparison, the non-discounted rate is much higher. Lexis/Nexis charges a $50 per month subscription price, a $33 per hour connect rate, a per search charge between $6 to $50, and display charges of $.025 per line. Under this pricing structure, a ten minute search at the full rate results in average cost of $13.70. Mick O'Leary, "NEXIS Positions for the 90s," Online Access, Spring 1993, 36-38. One newspaper, USA Today, was paying up to $18,000 per month for Lexis/Nexis before it changed to a less expensive service. Kathryn McCabe, "The Fortune 500 Online," Online Access, Spring 1993, 33.

32. This sample constitutes 2.41 percent of the 414 schools of journalism and mass communication nationwide. The 178 faculty members in the sampling frame were 3.8 percent of the 4,668 professors within the discipline. Gerald M. Kosicki and Lee B. Becker, "Annual Census and Analysis of Enrollment and Graduation," Journalism Educator 47 (Autumn 1992): 70.

33. The construction of the instrument was done following guidelines set by Fowler. Floyd J. Fowler, Survey Research Methods (Newbury Park, CA: Sage Publications, Inc., 1988), 99-106.

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36. In these particular tests at least a quarter of the cells contained less than five subjects. Unfortunately, there was no means of raising the cell values without having to gather additional data.

37. The relative advantage factor was broken down into three subareas of convenience, time and productivity. The perceived need factor was addressed by two items.

38. Rensis Likert, "A Technique for the Measurement of Attitudes," Archives of Psychology 140 (June 1932): 5-54.

39. Ram's study of resistance to innovation was limited on several grounds. While the study had a high degree of internal validity, its use of undergraduate students as subjects in a laboratory setting reduced its external validity. Furthermore, the innovations used in the study were fictional consumer products, such as disposable paper underwear, bottled banana juice, freeze dried beer concentrate and roast beef-flavored chewing gum. Since these products do not exist, consideration of their adoption could only be an abstract notion. This artificial quality might not have yielded cognitive and affective reactions similar to those that may be found outside a laboratory situation. S. Ram, "Marketing Strategies to Overcome Resistance: A Laboratory Experiment" (Ph.D. diss., University of Illinois, 1985), Appendix 1, 122.